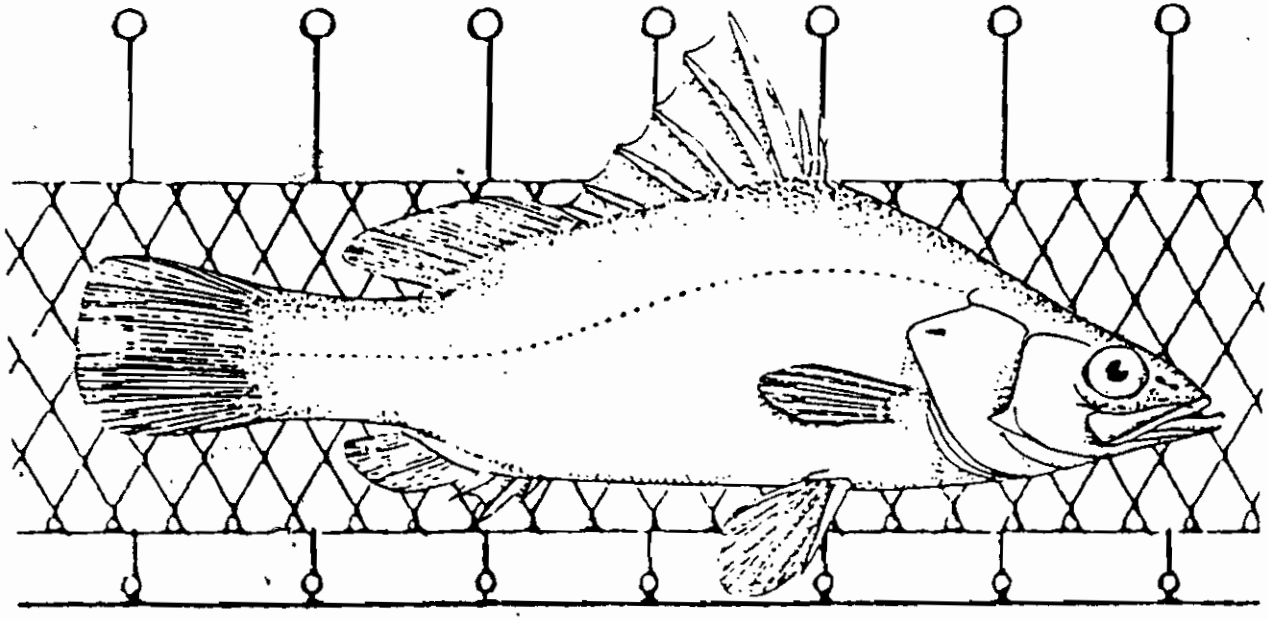
Report of the
Catch Assessment Survey

Fishery Survey of Kyoga Lakes



August 1990 - March 1991

By: L. Hartsuijker
T. Twongo and
D. Kibwika
Agricultural Development Project

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AGRICULTURAL DEVELOPMENT PROJECT
FISHERY SURVEY OF KYOGA LAKES
THE CATCH ASSESSMENT SURVEY : AUGUST 1990 - JULY 1991

PART I : GENERAL DESCRIPTION OF THE SURVEY

I.1.1 CONTENTS

This report presents the information obtained during catch assessment surveys made by the ADP Fishery Survey of Lake Kyoga and Lake Kwania between August 1990 and July 1991. It supersedes previous interim reports on these surveys.

The Kyoga lakes had not been surveyed in a long time. Information on the state of the stocks was largely confined conclusions drawn from data collected along the southern shore of L.Kyoga proper. The effect of harmful/illegal gear types on the stocks was not documented.

Part I provides a description of the survey. Part II comprises a review of the fishing strategies. Parts III and IV present the principal results obtained on L.Kyoga and L.Kwania. Part V presents a discussion of the main conclusions.

I.1.2 OBJECTIVES

The catch assessment survey was meant to evaluate the amount of fish taken out of L.Kyoga and L.Kwania, to obtain an impression on the state of the fish stocks and to illustrate the potential impact of different types of fishing gear on the resource.

I.2. COVERAGE IN TIME AND SPACE (See MAP)

Field trips were made from 10 - 17 August, 27 August to 7 September, 4 - 13 October, 23 November to 3 December, 12 to 20 December 1990, 1-11 February, 15-23 March and 17-28 July 1991: 71 days of sampling 116 landings at 58 sites, 20 on LAKE KWANIA and 37 on LAKE KYOGA. The area covered includes all of L.Kwania and most of L.Kyoga, except for the coast of Soroti district, where the security remained unsatisfactory. Lake Kwania has been covered twice; western L.Kyoga three times.

The coast of APAC (County Maruzi) from Wansolo to Kayei and the coast of Luwero west of Lwampanga, on the old maps a marshy area, is now open water mostly and forms a logical extension of L.Kwania. Kyoga water (the Nile Channel) is separated from Kwania water by a barrier of papyrus stands. Most likely the two lakes converge properly in the Kyoga Nile. Consequently, the Luwero coast from Lwampanga to Mooni has been considered as L.Kyoga. The coast of Apac (Maruzi county) as far as Kayei, has been classified as L.Kwania.

Research activities have been strictly limited to fishing villages along the shores of the lakes. On the inlet of the River Nile, the last landing covered was Kyankole. On the River Sezibwa, the last landing covered was Kyalusaka. At the western end, survey activities stopped at Kansiira and Kayei.

I.3. GENERAL SAMPLING DATA

I.3.1 FISHING AND LANDING PATTERNS

Almost all GILL NETS were used by night. Their catches were landed in the (early) morning hours, usually from around 6.30 to 9.30 AM.
Most SEINES were used during the day. Some of the seiners who landed their catch in the morning, had been fishing during the early morning hours only, which one could conclude from the state of the fish. Some seines were however used at night.
TRAPS were lifted during the early morning hours and fishermen with that gear brought their fish ashore around the end of the morning landings.
CAST NETS, which have been found in western and central L.Kyoga only, were used during the day in the Nile-channel mainly and catches were landed during the afternoon from 2 p.m. to sunset.
Fishermen who use HOOKS, landed their catches at any time of the day.

Along the Luwero coast, where security regulations were relaxed and where pick-ups waited for fresh fish to be transported to Kampala, landing started before dawn. Here the survey found boats which sold part of their catch on the water as well as boats which bought that fish. In places which were not visited by fish mongers waiting for fresh fish, landings were often spaced out. Many fishermen tended to do their last fishing at dawn, particularly when the weather at night had been a little rough and then they arrived a little later. In places like Nuseru, fishermen went across the lake to return between mid-morning and the early afternoon on the next day. In places like Naluboyo, boats were found landing from 6 am to 6 pm, with an interruption during the lunch hour only.

I.3.2 SURVEY PROCEDURE

The cost of random sampling had to be considered prohibitive, because of the funds to be spent on transportation and the time to be lost in travelling. Because of the statistical need for a large number of records, the survey has been sampling systematically in the large and medium-sized landing sites. During the census (May/June 1990) on L.Kyoga, 85% of the boats were found in 61 out of 114 landings. On L.Kwania, 50% of the boats were found in 10 out of 46 landings.

The survey team consisted of 11 staff members, including coxswains and drivers. Resident field staff of the Fisheries Department were usually invited to participate in the work.

The landing patterns made a lot of difference for the number of staff needed. On large landings the team was fully engaged, with 3 or 4 recorders. When fishermen arrived at leisure, even large landings could be covered by reduced staff. In many cases the survey team could be split in order to cover small neighboring landings as well.

The survey staff made camp in suitable sites, remained there one to three nights, particularly if there were a number of landings within short distance and if there was day fishing to be covered. Along the Kamuli coastline, the most effective way has been to move camp almost every day, reaching the next sampling site in time before the afternoon landings.

Fishermen tended to hide their illegal gear. In the initial stages of the survey this was for them often a reason not to go fishing on the first day ADP/FS staff put up camp. But the survey intended to get as much samples as possible from all gear types. Therefore in several cases the sampling was repeated, to get a good sample and to show the fishermen that the survey was not susceptible to evasive tactics.

In the course of the year, most fishermen appeared to appreciate the objective of the survey more positively. At least they recognized the fact that we meant them no harm. But it has remained useful to sample neighboring landings first by surprise, allow for the good news to spread and sample the camping site on the next day.

On large landings like Bukungu, Kayago and Bangala, organization at the landing through the existing calling point and help of resident authorities permitted sampling of most if not all boats. In such places the landing committees and boat owners were often pleased with the activity, because fishermen could not escape the payment of local fees and taxes. Along the Luwero shore, where fish was sold on the water and most landings were clogged by masses of water hyacinth, some landings had to be organized for sampling purposes. Occasionally sampling was done from a canoe in the inlet of the landing.

Sometimes the survey team has been thanked for the work. Its presence on the lake underlined the fact that peace had come back.

I.3.3. SAMPLING PROCEDURE

The survey made use of a simple sampling form (Annex A). This form included questions about the gear type, mesh size, numbers of nets, hooks or traps, the number of fishing days in the week and the ownership of boat and gear. Records of the fish covered: Oreochromis niloticus, Lates niloticus, Protopterus aethiopicus, Bagrus docmac, Clarias mossambicus, Tilapia zillii, Oreochromis leucostictus and "other" fish. The most common record in "other" was Barbus altianalis.

The catches were counted and quantities weighed in plastic buckets. The mesh size of gill nets, seines and cast nets was often checked by a member of the survey staff. Boats which had bought fish were not sampled. Boats which had sold fish were not sampled either. The samples collected along the south-western shore of L.Kyoga, may still included a few boats which had sold their large fish.

The total sample was biassed in favour of SEINES and CAST NETS because these were recorded during the day, when the survey team could catch every boat landing. In fact, a number of landings was specifically chosen to obtain data on such gears. The sampling schedule was arranged to record as much of the day fishing as possible, but as the survey team had to move between camping sites it could not sample day fishing at all times.
TRAPS and HOOKS were under-sampled, because a relatively large number of the fishermen using these gears reside on the smaller landings. Hooks have probably been under-sampled also because fishermen with that gear do not always keep to the main landing hours.

Biassed sampling with respect to different gear types was expected. Corrections were made by calculation of the total catch according to the numbers of different gear types recorded during the census.

The following table presents a summary of samples by fishing gear:

Gillnets	Seines	Castnets	Traps	Hooks	Total	CRUISE.No
1958	336	69	85	47*	2495	CAS 01-07
258	25	-	2	9*	294	KWANIA N
98	82	-	11	2	193	KWANIA S
1602	229	69	72	36	2008	KYOGA 01-07
600	139	66	17	14	836	CAS 08

*) 2 boats with hooks and gill nets

I.4. THE COMPOSITION OF THE TOTAL CATCH

The following table presents a summary of the spp.composition. More details have been provided in parts II, III and IV.

TABLE THE SPECIES COMPOSITION IN 2495 CAS SAMPLES CR.01-07

LAKE KYOGA	N.Fish	Σ.Weight	Av.W.Fish	W.%%
Oreochromis niloticus	89519	50234	561 g	79.6
Lates niloticus	30384	11613	382 g	18.4
Other species	2406	1289	536 g	2.0
TOTAL KYOGA SAMPLES	122309	63135 Kg		
LAKE KWANIA				
Oreochromis niloticus	10299	5394	527 g	41.1
Lates niloticus	23718	6811	287 g	51.9
Other species	2367	923	390 g	7.0
TOTAL KWANIA SAMPLES	36314	13129 Kg		
TOTAL SAMPLING	139442	69538 Kg		

The samples provided information on the composition of catches made by different gear types. During the analysis it became evident that the catches in L.Kyoga and L.Kwania were so much different that the data ought to be kept separate.

AREA	O.NILOTICUS		L.NILOTICUS		OTHER SPP	
	%%	Av.W.	%%	Av.W.	%%	Av.W.
LAKE KYOGA	79%	562	19%	326	2%	507
LAKE KWANIA	41%	523	52%	289	7%	390

The Nile Tilapia was the most important species in the catches on L.Kyoga. The Nile Perch was more abundant on L.Kwania, particularly in the northern part.

I.5. DISTRIBUTION OF THE FISH

From observations on the lake and questions to fishermen, it became clear that the most important fishing concentrates on and around the deeper water. The approximate position of such areas was known, but little or nothing about their size and their depth. There is the Nile channel, from west of Bukungu to Lwampanga. There is deep water near to the coast of Serere county and there is a channel along the Lira shore of L.Kwania. In northern Lake Kwania Nile Tilapia was almost absent from the central areas.

Deep water would appear to be the habitat for larger (breeding) specimens of both major species. A depth sounding survey is needed to determine the size and location of such areas.

I.6. MESH-SIZES.

The mesh size of the fishing gear was recorded. In seines this was the mesh size of the cod-end. In the case of gillnets the gear was often checked first because fish in boats with uniform gear can be sampled by counting only, and the weight calculated afterwards. This was done on large landings, when there were not enough balances to weigh the catch of all boats when many of them arrived at the same time.

An experienced recorder can estimate the mesh size of the gear by looking at the size of the fish. Because of the tendency to hide illegal gear, it has been useful to make that estimate before the question was put to the fisherman. Workers sometimes pretended not to know the type and numbers of nets they were using.

There was not always time to check the mesh size of gill nets in all boats, so this was done in case of doubt. It was necessary to check, because fisherman could not be given the chance to think that they could get away with whatever they liked to declare and they tried all the time. Since fishermen found that the survey team was not engaged on law enforcement, the information obtained was usually correct. The recorded mesh sizes of some gill nets were corrected afterwards, particularly 4" nets declared as 4,5", when the average weight of Nile Tilapia was found below 300 grams per fish.

The average size of Nile Tilapia caught by gill nets with 4", 4.5" and 5" mesh used passively, was found to be much larger that of those caught by active fishing with the same type of net (see par.II.1.2).

A practical check on the mesh size was found in the weight of 40 fish (the volume of the plastic buckets). 40 fish at 14 Kg corresponded to a pure 4.5" mesh gill net. More fish in that weight indicated the presence of other mesh sizes and the observation often led to a change in the declaration of fishermen as regards the numbers and sizes of their nets.

PART II : A REVIEW OF THE FISHING STRATEGIES

II.1 GEAR TYPES

Fishing gear such as gill nets catching under-sized fish, and illegal gear such as seines and cast nets were found widely spread and used.
There was a lot of discussion on the harmful effects of various gear types, but these effects had not been documented previously. For that reason it seemed useful to describe the use that fishermen make of their fishing gear and the potential impact on the stocks.
Consequently the following paragraphs present many tables with numbers which have to be regarded as records in support of measures (to be) taken with respect to the management of the resource.

II.1.1 CATCHES MADE BY GILL NETS

On L.Kyoga, about 50% of the gillnet fishermen used nets with meshes smaller then 5", particularly 4.5" - often combined with 5" mesh nets. On L.Kwania 70% of the gill nets had meshes below 5", including gill nets with 2.5", 3", 3.5" and 4" mesh in various combinations.
Details are presented in the tables below, data for Northern and Southern Lake Kwania have been kept separate.

In the northern part of L.Kwania, gill nets with mesh sizes of <4", are (mainly) used to catch Nile Perch and that is done by means of passive fishing. In southern L.Kwania they also catch smaller Tilapia species and hybrids between them.
On L.Kyoga gill nets of 4", sometimes in combination with nets of 4.5", are not always used for passive fishing on Nile Perch. They are mainly found in macrophyte areas and around rivers inlets.

In L.Kyoga nets of 4.5" and 5" mesh or their combination, aimed at the capture of medium sized Tilapia mainly (20 to 27 cm TL). The Nile Tilapia was not very abundant in northern L.Kwania and there these nets were used for fishing Nile Perch.
Nets with meshes of 6" and larger were fishing for large Nile Tilapia and large Nile Perch. Most of them were used for passive fishing.
The group GX includes data from fishermen who use 3 to 4 different net types together, ranging from 4" to 7" in L.Kyoga and 3,5" to 7" in L.Kwania. They were used to catch Nile Perch by passive fishing.

Mixed gear (fishermen using gillnets with different mesh sizes) caught more than single gear. Combinations of nets with illegal mesh sizes (≤ 4.5") produced more fish than those with legal mesh sizes. The table below only used data in the cases of knowledge with respect to the ownership of these nets.

When combinations of 2 different mesh sizes were used, the catches included more Nile Perch. The catch per net was higher if only one type was used, but fishermen with such nets had less nets per boat. The data reflect differences between active and passive fishing.

GN ILL refers to all nets which catch under sized fish (4" to 4.5+5" combination). GN LEG includes nets with meshes of 5" and above. The rest group consists of rare combinations of mesh sizes together.

THE SPECIES COMPOSITION OF CATCHES MADE BY GILL NETS BY MESH
LAKE KYOGA DATA FROM CAS.CR.01-07 : AUGUST 1990 - MARCH 1991

GILLNETS #-SIZES	NO BT	STATISTICS AV.W	St.D	AV.W. FISH ONil	LNil	PERCENTAGES ONil	LNil	OTH.
4	36	34,6	28,3	335	556	76,4	14,5	9,1
4,5	428	30,8	30,9	436	556	91,3	5,0	3,7
4,5 5	238	40,9	33,4	478	624	88,6	10,5	0,9
4 4,5	13	26,6	19,5	398	615	88,8	3,6	7,7
4 5	6	38,7	20,1	666	617	41,0	55,8	3,1
5	524	26,0	23,4	545	668	91,1	7,9	1,0
5 6	34	30,6	19,6	906	756	73,1	26,6	0,2
6	212	23;0	19,7	1134	1487	86,7	12,6	0,7
6 7	21	27,4	23,2	1398	1649	70,5	28,4	1,1
7	26	31,3	24,0	1887	3200	76,8	23,2	0,0
7 8	8	17,3	9,4	2121	6913	59,9	40,1	0,0
GX	34	43,0	26,1	831	834	29,4	69,5	1,0
ILL	729	34,3	31,7	447	591	89,0	8,1	2,9
LEG	876	26,3	22,7	668	916	83,8	15,3	0,9

THE SPECIES COMPOSITION OF CATCHES MADE BY GILL NETS BY MESH
NORTHERN LAKE KWANIA, DATA FROM CAS.CR.02-04-07

GILLNETS # - SIZES	No BT	STATISTICS AV.W	ST.D	AV.Wt.FISH ONil	LNil	PERCENTAGES ONil	LNil	OTHER
3 3,5	5	20,4	8,0	565	391	17,2	82,4	0,5
3,5	15	15,8	9,2	400	461	14,2	83,7	2,2
3,5 4,5	11	13,0	7,9	689	574	4,3	92,5	3,2
4	62	18,7	16,7	369	459	50,1	47,9	2,0
4 4,5	22	20,0	8,8	440	496	51,0	47,6	1,3
4,5	91	16,1	12,6	453	569	54,6	43,4	2,0
4,5 5	10	21,3	15,7	407	836	22,5	77,2	0,2
5	4	18,9	19,0	591	700	94,5	5,5	0,0
7	5	15,8	13,6	1867	4083	7,1	92,9	0,0
REST	24	16,3	15,8	771	751	30,1	67,9	2,0
ILL	236	17,0	13,1	418	522	44,0	54,1	1,9
LEG	13	23,0	22,0	1001	3427	46,9	56,2	0,0
GX	9	18,3	12,4	552	593	11,1	86,8	2,1
ALL	258	17,3	13,7	437	556	43,0	55,2	1,8

THE SPECIES COMPOSITION OF CATCHES MADE BY GILL NETS BY MESH SOUTHERN LAKE KWANIA, DATA FROM CAS.CR.02-04-07

GILLNETS # - SIZES	No BT	STATISTICS AV.W	ST.D	AV.Wt.FISH ONil	LNil	PERCENTAGES ONil	LNil	OTHER
4	9	29,6	19,6	308	519	75,4	9,2	15,5
4 4,5	2	10,8		558	NONE	85,2	0,0	14,8
4,5	23	26,5	16,6	433	559	83,1	7,1	9,8
4,5 5	4	32,7		474	500	96,0	1,1	2,8
5	39	18,5	12,3	599	735	87,6	3,2	9,3
6	15	22,5	13,7	1130	1616	84,9	9,1	6,0
REST	6	24,3		504	2000	79,0	9,6	11,4
ILL	39	27,6	17,2	394	547	83,3	6,6	10,1
LEG	59	19,6	12,5	715	1188	85,4	5,7	8,9
ALL	98	22,8	15,1	515	741	84,4	6,1	9,5

LAKE KYOGA : GILL NET CATCHES MADE BY SINGLE AND MIXED GEAR

GILL	NET	SUM NETS	NO BTS	AV.W Kg	CATCH NET	GN / BOAT	PERCENTAGES ONil	LNil	OTHER
ONE	ALL	7326	1027	28,1	4.0	7,1	89,7	8,0	2,1
MIX	ALL	3528	285	39.0	3,1	12,4	85,2	13,7	1,1
ONE	ILL	2278	369	32,0	5,2	6,2	90,9	5,1	3,9
MIX	ILL	2502	228	41,7	3,8	11,0	87,8	10,9	1,2
ONE	LEG	5049	658	26.0	3,4	7,7	88,8	10,1	0,9
MIX	LEG	1026	57	28.0	1,6	18,0	69,7	30,5	0,5
GX	ILL	894	28	45,2	1,4	31,9	28,9	58,6	1,1

Gill nets without data on mesh size are not included in this table.

II.1.2 PASSIVE AND ACTIVE FISHING

The survey did not inquire into use of the tycoon. However, the differences between active and passive fishing are visible in the samples and can be noted from the high average number of nets used (between 14 and 60), and the comparatively higher catches with a substantial amount of Nile Perch. For all evidence the Nile Perch does not respond, or reacts negatively to the beating.

Passive fishing in Lake Kyoga was particularly done with gill net combinations of 4+5", 5+6", and nets of 6" and larger. Consequently about 7% of the fishermen would appear to refrain from beating. In L.Kwania passive fishing was found common even with relatively small numbers of nets, probably because of the scarcity of Nile Tilapia.

TABLE: PASSIVE AND ACTIVE FISHING WITH GILL NETS L.KYOGA ONLY

GILL MESH	NETS N/BOAT	NUMBERS OF NETS	No OF BTs	CATCH PER NET KG	CATCH PER BOAT KG	AVG.WEIGHT ONil G	AVG.WEIGHT LNil G	COMPOSITION ONil %	COMPOSITION LNil %	COMPOSITION OTHER %
4	1-10	727	119	8.6	52.3	304	469	97.9	1.6	0.5
4	15-20	35	2	1.3	22.5	533	385	17.8	82.2	0.0
4,5	1-12	2517	414	5.0	30.5	435	536	91.8	4.4	3.8
4,5	13-30	122	7	3.2	56.5	447	685	74.7	24.9	0.3
4,5+5	1-12	1874	214	4.7	40.9	468	586	93.1	6.0	0.9
4,5+5	13-40	662	24	1.5	40.8	747	669	48.0	51.2	0.8
5	2-12	3378	488	3.8	26.1	542	642	92.1	6.8	1.1
5	13-44	396	20	1.7	33.3	596	841	71.0	28.8	0.2
5+6	TO 12	142	16	3.0	26.9	847	582	90.0	10.0	0.0
5+6	13-60	496	18	1.2	33.8	976	800	61.2	38.4	0.4
6	1-12	1217	186	3.4	22.0	1126	1290	91.2	8.0	0.8
6	13-30	465	24	1.6	31.2	1188	1840	61.5	38.4	0.1
6+7	TO 12	68	7	2.8	26.9	1413	1340	89.3	10.7	0.0
6+7	12-44	279	14	1.4	27.6	1388	1705	61.4	37.0	1.6
4	ALL	762	121	8.2	51.8	304	443	97.4	2.2	0.5
4,5	ALL	2654	425	5.0	30.9	436	552	91.4	4.9	3.7
4,5+5	ALL	2536	238	3.8	40.9	478	624	88.6	10.5	0.9
5	ALL	3814	520	3.6	26.1	545	668	91.1	7.9	1.0
5+6	ALL	638	34	1.6	30.6	906	756	73.1	26.6	0.2
6	ALL	1689	212	2.9	23.0	1134	1487	86.7	12.6	0.7
6+7	ALL	347	21	1.7	27.4	1398	1649	70.5	28.4	1.1

In L.Kwania there were only little differences between the catches made by small meshed and large meshed nets. There were no remarkable differences between single and mixed gears.

II.2. CATCHES MADE BY SEINES

On L.Kyoga, about 12% of the boats used seines; on L.Kwania this was about 11%. The mesh size of the cod-end was usually checked by a member of the survey staff. The following tables summarize data on the catches made by seines :

LAKE KYOGA : STATISTICAL DATA FOR SEINES

MESH SIZES	NO BT	STATISTICS AV.W	St.D	AV.W ONil	FISH LNil	PERCENTAGES ONil	LNil	OTH.
?	19	51,9	24,8	960	249	43,5	56,2	0,3
1,0	1			467	194	24,6	75,0	0,4
1,5	40	43,6	26,3	878	212	43,3	55,8	0,9
2,0	127	44,4	29,1	835	227	48,5	49,0	2,5
2,5	19	77,8	61,4	871	300	64,2	35,6	0,2
3,0	19	49,6	25,7	1066	290	46,5	52,6	0,9
4,0	4	84,5	54,1	1331	311	87,1	12,8	0,1
ALL	229	49,0	34,3	885	236	50,1	48,3	1,5
NIGHT	56	53,4	33,4	1002	282	57,9	38,7	3,4
DAY	173	47,5	34,5	841	226	47,3	51,8	0,8

NORTHERN LAKE KWANIA : STATISTICAL DATA FOR SEINES

MESH SIZE	No BT	STATISTICS AV.W	ST.D	AV.W ONil	FISH LNil	PERCENTAGES ONil	LNil	OTHER
?	6	78,5	24,3	227	158	2,1	97,5	0,3
1,5	1			667	194	5,7	94,3	0,0
2	11	79,0	43,5	374	163	5,6	93,4	1,0
2,5	5	85,5	69,8	680	109	0,8	98,0	1,2
3	1			477	182	15,8	81,3	2,9
3,5	1			200	200	4,0	96,0	0,0
ALL	25	77,7	45,7	363	147	4,1	94,9	0,9

SOUTHERN LAKE KWANIA : STATISTICAL DATA FOR SEINES

MESH SIZE	No BT	STATISTICS AV.W	ST.D	AV.Wt.FISH ONil	LNil	PERCENTAGES ONil	LNil	OTHER
?	9	42,6	22,7	1774	480	51,4	40,6	8,0
1,5	9	52,3	37,1	374	355	14,5	66,9	18,7
2	24	53,7	25,6	592	367	31,0	54,5	14,5
2,5	12	26,2	24,1	882	328	33,6	57,9	8,5
3	20	62,2	32,7	927	339	29,1	60,5	10,5
3,5	8	54,1	35,2	1406	394	38,7	60,9	0,5
ALL	82	50,4	31,6	814	361	31,4	57,3	11,2

Statistical data in Kg , Av.Weight of fish in grams.

The size of the sample for Northern Lake Kwania was too small to draw useful conclusions, but these data show that there was little else but very small Nile Perch to be caught in that area.
In L.Kyoga and in Southern Lake Kwania, seines generally caught Nile Tilapia of a good size: the average weight of 814 to 885 grams corresponds to a size of 34-35 cm TL..
However, 50 - 60 % of the catch made by seines in these areas consisted of large numbers of small Nile Perch. Seines used on L.Kyoga during the day, catch more Nile Perch than those used at night. Night fishing provides a slightly larger total catch.

Seine fishermen seem to prefer cod-end meshes of 2" and it is not at all clear why they do. On first sight the data collected in L.Kyoga and southern L.Kwania show that the average weight of Nile Tilapia increases with the cod-end mesh size. A similar impression can be gained with respect to Nile Perch in L.Kyoga, but not in southern L.Kwania. However, the size of Nile Tilapia caught by seines has no relation to the size of the cod-end mesh. Also, seine fishermen never landed under-sized Nile Tilapia, except in northern L.Kwania. The size of Nile Perch in seines may to some extend be related to the cod-end mesh size, but even that seems doubtful. A comparison between Nile Perch data collected in L.Kyoga and southern L.Kwania
(Av.W. LNil) suggest other selection mechanisms.

Moreover, it appeared that seines with a small meshed cod-end did not catch more than those with larger meshed cod-end. The average weight of Nile Perch in seines with meshes of 2.5" to 4" was larger than the catch of seines with 1.5" and 2" cod-end mesh.

The only possible conclusion was that fishermen used seines with different cod-end meshes in different environments, those with larger cod-end meshes in deep water mainly. Consequently the catches would reflect the distribution of specimens from both species. Seines with small meshed cod-ends must be heavier to pull and slower to lift, particularly in deep water.

An attempt was made to investigate that situation by sorting the available data for L.Kyoga only, according to characteristics like the percentage of Nile Tilapia in the catches, fishing by night and by day, and the percentage of other species in the catches. Unfortunately the sample size became rather small in several categories.

The seine catches made by day and by night (table A) show differences in the average weight of Nile Tilapia, but there is no clear trend related to the cod-end mesh size. Most remarkable in this case however is the fact that the smallest Nile Perch have been caught in seines with that largest cod-end mesh (table A).

A. SEINE CATCHES BY NIGHT AND BY DAY

SEINES	NO BTs	# MESH	CATCH BOAT	% ONIL	% LNIL	% OTHER	AV.Wt ONIL	AV.Wt LNIL
NIGHT	8	1,5"	55,1	54,7	39,4	1,9	1218	450
DAY	32	1,5"	40,7	40,9	58,5	0,6	911	585
NIGHT	27	2"	43,4	53,3	36,4	7,5	878	378
DAY	100	2"	44,7	46,5	52,1	1,1	1014	531
NIGHT	16	2,5-4"	71,4	56,6	42,8	0,5	1270	294
DAY	26	2,5-4"	62,2	64,0	35,6	0,4	853	297

B. SEINE CATCHES BY NIGHT, DAY AND PERCENTAGE OF O.NILOTICUS

SEINES % ONIL		NO BTs	# MESH	CATCH BOAT	% ONIL	% LNIL	% OTHER	AV.Wt ONIL	AV.Wt LNIL
TO 30%	A	4	1,5	58,9	22,8	65,5	3,5	1041	655
75-100%	A	4	1,5	51,3	86,6	13,4	0,0	1395	178
TO 30%	P	12	1,5	38,7	13,1	85,8	1,5	694	858
30-50%	P	8	1,5	49,7	39,1	60,9	0,0	867	609
50-96%	P	12	1,5	36,6	69,9	29,7	0,3	1138	297
TO 30%	A	7	2	39,8	13,3	64,8	15,1	613	648
30-50%	A	6	2	32,3	38,2	55,4	4,8	846	554
50-99%	A	14	2	49,9	79,6	14,1	5,3	1005	151
TO 30%	P	33	2	45,5	17,6	81,4	0,5	948	814
30-50%	P	23	2	50,9	39,6	60,1	0,2	937	601
50-70%	P	21	2	37,3	58,5	39,2	1,4	937	392
70-100%	P	23	2	44,1	83,8	13,7	2,9	1252	150

C. L.KYOGA - SEINE CATCHES AND % OTHER SPECIES

SEINES		NO BTs	CATCH BOAT	% ONIL	% LNIL	% OTHER	AV.Wt ONIL	AV.Wt LNIL
%OTH	0	174	48.7	53.0	47.0	0.0	799	245
%OTH	0-1	41	59.3	54.8	44.4	0.8	750	233
%OTH	2-3	20	39.9	48.1	49.2	2.8	635	274
%OTH	4-9	20	45.5	60.7	32.5	6.8	558	181
%OTH	10-78	28	36.5	66.7	12.6	20.7	486	242

When the catches made by seines with cod-end meshes of 1,5 and 2" are sorted according to the percentage of Nile Tilapia in the catches, (table B) it appears that the average weight of Nile Tilapia increases with the percentage, whereas the average weight of the Nile Perch decreases.

When seines catches are sorted according to the percentage of other species, small Tilapia species which are caught near to the shore line mainly,(Table C) it appears that the average weight of Nile Tilapia decreases. In this case the quantity of Nile Perch decreases without clear changes in the average weight. The diverging patterns of distribution are of interest to further investigation. The data are presented here as a record.

II.3 CAST NETS

Cast nets were not recorded during the census, because those nets are not left in the boat. During the survey, many cast nets were found operating during the day along the Nile Channel in L.Kyoga. Usually most of them were concentrated in the same area and during the survey period, the fishermen were moving from east to west, starting at the landings in Mukono district towards the Nile channel into the L.Kwania area. The number of fishermen using cast nets was estimated at 200.

Cast nets are a cheap alternative to the use of gill nets in deep water. The investments made in cast nets are minimal; many fishermen using this gear rent the boat. The cast nets are harmful to the breeding stock of the Nile Tilapia. This was illustrated during the survey period.

L.KYOGA CAST NETS	NO BT	STATISTICS AV.W	St.D	AV.W. FISH ONil	PERCENTAGES ONil	LNil	OTHER
1990	69	25,3 ±	18,6 Kg	1069 g	99,2	0,4	0,4
1991 JULY	66	24,4 ±	16,3 Kg	638 g	99,6	0,2	0,2

During August-October 1990, most of the cast nets had mesh sizes from 6 to 7 inch and they caught large to very large Nile Tilapia in the range of 45-57 cm TL. The determination of sex and maturity showed that almost 95% of them were breeding males.

For all appearances castnet fishermen have been capable of cleaning the area in a short time. During July 1991, cast nets were sampled again. Their mesh size had reduced to a range of 3.5 to 4.5 inch. Large breeding Nile Tilapia were no longer found in their catches. Also castnet fishermen had disappeared from places where they had been many less than a year ago.

II.4 TRAPS AND HOOKS

L.KYOGA GEARS	NO BT	STATISTICS AV.W	St.D	AV.W. FISH ONil	LNil	PERCENTAGES ONil	LNil	OTHER
HOOKS	31	22,9	22,3	667	13714	0,3	81,3	18,4
TRAPS	72	19,0	20,0	474	540	95,5	0,2	4,3

L.KWANIA AREA	GEAR	NO BT	STATISTICS AV.W	ST.D	AV.W. FISH ONil	LNil	PERCENTAGES ONil	LNil	OTHER
KWN	HOOKS	9	9,7	5,2	400	4700	0,9	37,8	61,3
KWN	TRAPS	2	8,4		380	NONE	67,9	0,0	32,1
KWS	HOOKS	2	29,6	25,7	400	300	4,7	0,5	94,8
KWS	TRAPS	11	17,6	13,2	498	NONE	82,1	0,0	17,9

Traps catch Nile Tilapia mainly, and some of the smaller tilapias Oreochromis leucostictus and Tilapia zillii. Fishermen with hooks catch Nile Perch and Protopterus mainly.

PART III : CATCH ASSESSMENT SURVEY IN LAKE KYOGA PROPER

III.1. INTRODUCTION

This chapter deals with the results of CAS surveys made by the ADP Fishery Survey between August 1990 and March 1991 on Lake Kyoga only.

III.2. COVERAGE IN TIME AND SPACE

CAS surveys were made from 10 - 17 August, 27 August to 7 September, 4 - 13 October, 23 November to 3 December, 12 to 20 December 1990 , 1-11 February and 22-23 March 1991: 60 days of sampling 89 landings at 37 sites. The area covered includes Lake Kyoga, except for the coast of Soroti district where the security remained unsatisfactory. Some information from that area was obtained at landings along the southern shore in Kamuli district. The lake has been covered twice.

A last survey, covering L.Kyoga west of the Nile was made during July 1991. Results of this survey have been reported separately and are not included in the figures presented by this report.

Kyoga water (the Nile Channel) and Kwania water are meeting some-where in the area west of Lwampanga. For the time being the Luwero coast has been considered as L.Kyoga.

III.3. SAMPLING DATA

III.3.1 LANDINGS SAMPLED

The Fishery Survey has been sampling systematically in the large and medium-sized landing sites. On Lake Kyoga, during the census, 85% of the boats were found on 61 out of 111 landings. Usually these places were chosen for the survey. On large landings the survey team was fully engaged, with 3 or 4 people recording. But if fishermen tend to arrive at leisure, large landings could be covered by reduced staff and often the survey team divided in order to cover small landings.

III.4.2 NUMBER OF SAMPLES AND FISHING GEAR.

The following table presents a summary of samples by gear:

Gillnets	Seines	Castnets	Traps	Hooks	Total
1602	229	69	72	36	2008

III.4.3 THE COMPOSITION OF THE TOTAL SAMPLE

The species composition is given in the table below.

TABLE. THE SPECIES COMPOSITION IN 2008 CAS SAMPLES CR.01-07

LAKE KYOGA	N.Fish	Σ.Weight	Av.W.Fish	W.%%
Oreochromis niloticus	89519	50234	561 g	79.6
Lates niloticus	30384	11613	382 g	18.4
Protopterus	162	395	2198 g	0.6
Tilapia zilli	717	253	353 g	0.4
Oreochromis leucosticus	1168	423	362 g	0.7
Bagrus + Clarias	54	84	1561 g	0.1
Others	305	134	438 g	0.2
TOTAL KYOGA SAMPLES	122310	63135 Kg		

The group "OTHERS" comprises records of Barbus sp. mainly.

III.4.4 DISTRIBUTION OF THE FISH

The most important fishing concentrates on the deeper water. There is the Nile channel, from west of Bukungu to Lwampanga. There is deep water near the coast of Serere county. The approximate position of such areas is known, but little about their size and their depth.

caught now. This amounts to catches between 5400 and 16000 tons more.

III.5. EFFECTIVE FISHING TIME

The fishing boats on L.Kyoga operate on all days of the week. But it has been noted that fishing canoes boats are not going out 7 days per week. A part of them remains idle everywhere under all conditions. Bad weather is often only a reason to go out a little later. A lack of workers is what some people say. Perhaps the arrangements between owners and workers are inconvenient during periods with poor catches.
The CAS form includes a question about the number of fishing days. The answer amounts to an average 5.4 days per week: That figure refers to the fisherman, not to the boats because many boats are manned with workers or hired. Some boats are used twice, mainly for the use of cast nets, hooks and traps. The exact frequency of use is very difficult to obtain by a non-resident survey team and it has a large influence on the total estimate.

The average answer given amounts to 5.4 days/week and this would be an underestimate. Under the conditions, it is assumed that boats are used about 6 days per week, or 6/7 x 365 = 313 days/year and that figure is taken as a raising factor in the calculation of the total catch.

III.6. THE TOTAL CATCH : LAKE KYOGA ONLY

According to the frame survey on Lake Kyoga only, there were 2860 operational fishing boats in that area. In view of observations during the survey, the number of cast nets was estimated at 200, and their catch added to the total. The numbers of boats using different gill nets and seines have been calculated from the total in the census and their frequency in the sample. During the census gear types were not recorded for 95 boats. Their average catch is calculated on the basis of the average of all identified gears together.

CALCULATION OF TOTAL CATCH IN L.KYOGA MINUS SOROTI ARM

KYOGA GEARS	MESH SIZES	EFFORT 6 D/Wk	CENSUS DATA	AV.W KG	FRS DATA	CATCH IN METRIC TONS ONIL	LNIL	OTHER	TOTAL
G-NETS	4	6	53	34,6	53	435	82	52	569
G-NETS	4 4,5	6	19	26,6	19	141	6	12	158
G-NETS	4 5	6	9	38,7	9	44	59	3	106
G-NETS	4,5	6	621	30,9	621	5491	297	221	6009
G-NETS	4,5 5	6	348	40,9	348	3941	468	41	4449
G-NETS	5	6	760	26,1	760	5650	489	64	6203
G-NETS	5 6	6	50	30,6	50	348	127	1	475
G-NETS	6	6	310	23,0	310	1935	282	15	2232
G-NETS	6 7	6	31	27,4	31	185	75	3	263
G-NETS	7	6	37	31,7	37	279	84	0	363
G-NETS	7 8	6	12	17,3	12	38	25	0	63
G-NETS	7 10	6	9	15,1	9	5	37	0	41
G-NETS	MIX	6	50	43,0	50	197	465	7	669
CAST NETS		6	200	25,3	200	1573	6	7	1586
HOOKS		6	98	22,9	98	2	570	129	701
TRAPS		6	100	19,3	100	575	1	26	602
SEINES	?	6	21	51,9	21	151	195	1	348
SEINES	1	6	1	85,3	1	7	23	0	30
SEINES	1,5	6	45	43,5	45	266	343	6	614
SEINES	2	6	143	44,4	143	965	975	49	1989
SEINES	2,5	6	21	77,8	21	335	186	1	521
SEINES	3	6	21	49,6	21	154	174	3	332
SEINES	4	6	5	84,5	5	104	15	0	119
SEINES	ALL	6	258	49,0	258	1982	1911	60	3953
SUM OF IDENTIFIED GEARS						22819	4982	641	28442
UNIDENT. GEAR		6			95	744	172	19	935
SUM ALL GEARS						23563	5155	660	29378
SPECIES COMPOSITION						80%	18%	2%	100%

If the sampling on L.Kyoga minus the Soroti arm between August 1990 and February 1991 would be more or less representative for the fishery throughout the year, the total annual catch amounted to about 29400 tons, with 80% Nile Tilapia and 18% Nile Perch. Illegal gear produced 60 % of the total catch.
Discussion: See Part V.

PART IV : THE CATCH ASSESSMENT SURVEY IN L.KWANIA ONLY

IV.1. COVERAGE

This chapter presents the information obtained on Lake Kwania only. L.Kwania was visited during CAS field trips from 2-5 September 1990, 25 November to 3 December 1990 and 16-22 March 1991: 22 days sampling 41 landings at 20 sites on L. KWANIA. Major landings were covered twice.

IV.2 DEFINITION OF AREAS

The coast of APAC (Maruzi) from Wansolo to Kayei and the coast of Luwero west of Lwampanga, formerly a papyrus swamp, is now open water mostly, with some floating islands on its north-eastern side. That water forms a logical extension of Lake Kwania. The Nile Channel has remained surrounded by stands of papyrus. The Luwero coast has been considered as L.Kyoga. The boundary between north and south L.Kwania has been put from a point east of Wansolo to the opposite shore in Kyoga county (Lira District).

IV.3. GENERAL SAMPLING DATA

IV.3.1 LANDINGS SAMPLED

On Lake Kwania there are no large landings and a few medium-sized. During the census, 50% of the boats were found on 10 out of 46 landings. These places were chosen for the survey. On L.Kwania the survey staff could conveniently be split up into 3 or 4 recording teams to cover a number of small landings. Little day fishing was done in northern Lake Kwania, but it was common in southern part of the lake, along the shore of Maruzi county.

IV.3.2 No. SAMPLES AND FISHING GEAR.

The following table presents a summary of samples by fishing gear:

Gillnets	Seines	Castnets	Traps	Hooks	Total	AREA
258	25	-	2	9*	294	KW.NORTH
98	82	-	11	2	193	KW.SOUTH
356	107	-	13	11*	487	KWANIA

*) including 2 boats with hooks and gill nets

IV.3.3 THE COMPOSITION OF THE TOTAL CATCH

The 487 samples comprise 36314 fish with a weight of 13129 Kg. The species composition is given in the table below. The group "OTHERS" comprises large numbers of unidentified Tilapia hybrids, all found in the southern part of Lake Kwania. There are some records of Barbus sp. and Mormyrus sp..

TABLE THE SPECIES COMPOSITION IN 487 CAS SAMPLES CR.02-04-07

LAKE KWANIA	N.Fish	Σ.Weight	Av.W.Fish	W.%%
Oreochromis niloticus	10299	5394	527 g	41.1
Lates niloticus	23718	6811	287 g	51.9
Protopterus	59	176	2975 g	1.3
Tilapia zilli	445	106	238 g	0.8
Oreochromis leucosticus	573	157	274 g	1.2
Bagrus + Clarias	71	118	1668 g	0.9
Others (many hybrids)	1219	366	301 g	2.8
TOTAL KWANIA SAMPLES	36314	13129 Kg		

IV.3.4 DISTRIBUTION OF THE FISH

From observations on the lake and questions to fishermen, it has become evident that there are very few Tilapia in the central areas of northern lake Kwania, but Nile Perch only. There is a channel along the Lira shore where the larger Perch were caught.

IV.4. GILL NETS

The table below presents the types of gill nets found. Since there was much passive fishing in L.Kwania, fishermen frequently did not bring their nets ashore. Declarations of the mesh size were accepted as they corresponded to the size of the fish and otherwise rejected.

TABLE : THE FREQUENCY OF GILLNETS BY MESH SIZE COMBINATIONS

MESH SIZE	No.	%%	MESH SIZE	No.	%%
3" and/or less	5	1.4	5.0"	43	12.1
3.5" and 4.0"	26	7.3	5.0" + 6.0"	2	0.6
4.0"	71	19.9	6.0"	16	4.5
4.0" + 4.5"	24	6.7	6.0" +	5	1.4
4.5"	114	32.0			
4.5" + 5.0"	14	3.9	OTHER/UNKNOWN	36	10.1
SUBTOTAL	254	71.3	SUBTOTAL	102	28.7

IV.5. THE TOTAL CATCH : LAKE KWANIA

IV.5.1 EFFECTIVE FISHING TIME

The CAS form includes a question about the number of fishing days. The answer amounts to an average 6.0 days per week: That figure refers to the fisherman, not to the boats, but since most boats were found used by the owner, that figure has been considered realistic. The recorded average effective fishing time is given in the table.

IV.5.2 CALCULATED TOTAL CATCH : L.KWANIA NORTH AND SOUTH

If the sampling on L.Kwania between September 1990 and March 1991 would be more or less representative for the fishery throughout the year, the total annual catch for L.Kwania can be calculated as follows (total weight in metric tons):

GEAR TYPE KWANIA NORTH	EFF DAYS	CENSUS DATA	AV.W KG	O.Nil TONS	L.Nil TONS	OTHER TONS	TOTAL TONS
GILL NETS	6.63	297	17,30	764	980	32	1776
HOOKS	4.25	29	9,67	1	24	38	62
SEINES	5.82	28	77,67	27	626	6	660
TRAPS	7.00	1	8,40	2	0	1	3
UNIDENTIFIED	6	62	22,14	132	286	10	429
SUM KW.NORTH		417		926	1916	87	2930
PERCENTAGE				32%	65%	3%	100%

GEAR TYPE KWANIA SOUTH	EFF DAYS	CENSUS DATA	AV.W KG	O.Nil TONS	L.Nil TONS	OTHER TONS	TOTAL TONS
GILL NETS	4,75	198	22,80	944	69	106	1118
HOOKS	6,00	17	29,55	7	1	149	157
SEINES	5,64	44	50,41	205	374	73	652
TRAPS	6,73	3	17,59	15	0	3	18
UNIDENTIFIED	6	13	34,30	70	53	16	140
SUM KW.SOUTH		275		1242	496	347	2085
PERCENTAGE				60%	24%	17%	100%

The calculation uses data from the 1990 census of L.Kwania. That census includes boats with unidentified gears. Effective fishing time for these boats has been estimated at 6 days and the average catch is estimated from the average over the total sample.

That brings the total annual catch for L.Kwania to about 5000 tons. For Northern Kwania that is 62,6 kg/ha/year (2930 tons from 468 km»), at a fishing density of 1,12 boats per km». For Southern Kwania that is 94,3 kg/ha/year (2085 tons from 221 km») at a fishing density of 1,24 boats/km». Considering the fact that catches are reported to be best during the rainy season, the total annual catch should be a little higher.

PART V : A DISCUSSION OF PRINCIPAL SURVEY RESULTS

V.1. INTRODUCTION

As explained in the INTRODUCTION TO THE ADP/FISHERY SURVEY OF KYOGA LAKES, because of the time needed for ANALYTIC STOCK ASSESSMENT, the time allotted and the limited funding , the project had no other option but the execution of a CATCH ASSESSMENT SURVEY. This survey was meant to evaluate the amount of fish taken out of the major lakes, to obtain an impression on the state of the stocks and to illustrate the impact of different fishing gear on the resource.

V.2. METHODS

The cost of random sampling was prohibitive. For statistical reasons there was a need for a large number of records. Therefore the survey team has been sampling in the large and medium-sized landing sites. The total sample was biassed for reasons given in part I (GENERAL DESCRIPTION OF THE SURVEY), but this was corrected by calculation of the total catch by gear type according to their numbers recorded during the census. For security reasons sampling has not been done in the "Soroti" arm of L.Kyoga.

During the analysis it became evident that the catches in Lake Kyoga Northern and Southern Lake Kwania were so different that the data ought to be kept separate. Detailed results have been presented in the chapters on CAS results.

V.3. TOTAL CATCH

The total catch for the 3 areas mentioned above was calculated on the basis of data obtained during survey cruises 1 to 7, between August 1990 and March 1991. The results for the survey period were :

LAKE AREA	CATCH M.TONS	SURFACE KM»	NO CANOES	CANOES PER KM»	YIELD PER Ha
L.KYOGA	29378	1905	2860	1,50	154 Kg
L.KWANIA (NORTH)	2930	468	417	1,12	63 Kg
L.KWANIA (SOUTH)	2085	221	275	1,24	94 Kg

Since sampling could not be done during the rainy season, the real total annual catch should have been higher. For L.Kyoga during eight months survey, the average weight per boat was 31,4 Kg. During July 1991, at the end of the rainy season that average was 40,9 Kg. When that average is used for the last 4 months of the calendar period, the total annual catch for the surveyed area could be estimated at around 33.850 tons, which represents 178 Kg/Ha. If that yield is extrapolated to the Soroti-arm (255 km») this would mean another 4500 tons. That would bring the total estimated potential catch for 1990/91 from L.Kyoga proper to around 38400 tons.

Nile Perch are allowed to come back in great numbers? At present, this question can not be answered because the fishery has suppressed the Nile Perch stock for such a long time, that the predatory effect on the Nile Tilapia has been much reduced and could not have been studied.

In view of the situation of Nile Perch stocks in the past, there should be enough food for an increase in the number of small Nile Perch under 50 cm, which are of less consequence to the Nile Tilapia.
Growth of Nile Perch to the minimum legal size should increase the yield from the lakes considerably.

If the breeding stocks remain protected by strict enforcement of the law with respect to seines and castnets, it may very well be possible that the fish stocks could sustain the effort made by 4,5" gill nets for the capture of Nile Tilapia and 4" nets used passively for the capture of Nile Perch and the minor Tilapia species in swamp areas. That might even found to be rationally sound exploitation. However, under the present circumstances, there is a need for firm management and firm evidence. It would be useful to obtain data on growth and mortality for Nile Tilapia and Nile Perch: growth from a tagging program and mortality from catch curves to be derived from CAS data.

The situation can be summarized as follows:

1) without effective enforcement of the available regulations, the fishery is slowly heading for further deterioration, and has been doing so for a long time;

2) seines and cast nets are being used by part of the fishermen at the expense of their majority. Rectification of that situation does not only require law enforcement, but also extension among the responsible authorities and within the fishing population.

3) if both major species managed to survive those conditions, there is every reason to expect that yields can be increased on a short term basis, particularly the yield of Nile Perch.

4) past data on catches have been too optimistic;

5) the population of Nile Perch can not be expected to return to the past high levels, because the relative scarcity of fish as food.

The Fisheries Rehabilitation Study, TDRI 1983, suggested that the "target recommended yield" for Lake Kyoga could be at around 65,000 tons,"set at around the 1970 production level; the period when the first fall off in the size of Nile Perch was reported ".Consequently, the TDRI estimate for the entire system, would lead to 48.750 tons for the yield from the 2 major lakes (180 Kg/Ha).

The truth on the real amounts landed will remain hidden. Up till today the principal fish stocks are not balanced. This is due to the severe control the fishery with seines has had on the Nile Perch population. This has lead to permanent and considerable fluctuations in the Nile Perch stocks and in the fishery itself (seines got themselves out of business periodically). These fluctuations make it very difficult to estimate the effect that the Nile Perch would have on the stock of Nile Tilapia and the potential yield in a properly managed fishery.

However, even when making allowances for the potential yield from the Soroti arm (± 255 km²) actual catches are far below the level of the most conservative estimate (TDRI), as the result of over-fishing.
With an average catch of 178 Kg/ha/year, at a density of 1,5 fishermen/km², L.Kyoga is still a very productive lake.

V.4. OVER-EXPLOITATION

For all evidence, the stocks of both major species, Nile Tilapia and Nile Perch are very resilient to the fishing effort. They manage to maintain a reproductive capacity which enables their stocks/yields to be sustained at certain levels. So far, the reproductive capacity does not appear fully endangered, although seines and cast nets have constantly threatened the breeding stocks.

This is most remarkable in case of the Nile Perch. The CAS recorded over 30.000 specimens of Nile Perch and the number of specimens of 70 cm or longer (spawning females) was less that 0.5%. In the case of Nile Tilapia, in the beginning of the survey, large numbers of large breeding males were found in the catches made by cast nets used in and around the Nile Channel between Bukungu and Lwampanga. Unfortunately, the cast nets were found capable of cleaning the area and getting themselves out of business within the survey period.

The data suggest that the fishery is engaged on economic over-fishing by means of al sorts of illegal fishing methods, as described in the chapter on fishing strategies, particularly on the Nile Perch Stock by means of seines catching large numbers of baby Perch. For all evidence obtained, such as data from beach seines collected between 1978 and 1983, fishermen using this gear also specialized in catching Nile Tilapia on their breeding grounds (a high proportion of ripe and spawning specimens in sampled catches).